MS/JL

THE SYDNEY COUNTY COUNCIL

BRANCH STANDING INSTRUCTION

GENERAL

No. 1002
Index No.
Date 29.4.74

BRANCH METERING SERVICES.

SUBJECT L.V. CURRENT TRANSFORMER METERING.

OBJECTIVE To set down the procedures and tests associated with L.V. current transformer metering installations.

MEANS OF ATTAINMENT.

TABLE OF CONTENTS.

1. GENERAL.

Single phase magnetic flotation meters having a basic current rating of 2.5A and a maximum continuous current rating of not less than 10A are the preferred energy meters for L.V. current transformer installations. All such meters, however, will be known as 5A C.T. meters.

Special metering equipment such as two rate energy meters, single and two rate energy demand meters and pulse emitting meters will continue to be of the polyphase type.

Where single phase 415V low power factor loads, such as welders predominate, it is possible that meter reversal would occur if single phase meters are installed. As this is undesirable, polyphase meters will be used in these instances.

To minimise account errors it was customary to ensure that the meter register recorded primary kilowatt hours directly; with the advent of computerised procedures this requirement became unnecessary and meters are now fitted with registers which record secondary kilowatt hours. It is therefore necessary to ensure that the correct transformer ratio constant becomes identified with the meter on the customer's account.

It is also necessary to prove that metering connections, polarity and ratio of current transformers are correct.

2. PROCEDURES AND RESPONSIBILITIES.

2.1 General.

The procedures and responsibilities detailed below are applicable to all low voltage C.T. metering. The additional requirements of low voltage demand metering (direct connected or transformer operated) are dealt with in B.S.I. No. 1042.

All C.T's will have had a Test Card (MS.82) attached at the time of test (See B.S.I. No. 1501).

2.2 Requisition.

All metering equipment for any one installation is ordered from a Meter Store by the E.I. Branch by the use of a blue Meter Requisition Slip I.37. Where a C.T. is involved, the Storeman receives a duplicate blue form, addressed M.S./F.M.I. (i.e. F-F.M.T.) and a white copy of the Connecting Officer's run sheet I.226.

2.3 Storeman.

The Storeman is to:-

(a) Issue the equipment required (See B.S.I. No. 1500).

(b) Forward the duplicate blue I.137 slip and the I.226 sheet to the F-F.M.T.

(c) Retain all other blue slips for the period shown in B.S.I. No. 203.

(d) Forward immediately to the F-F.M.T. any I.226 sheet where meters are not required (e.g. alterations to metering or transformer ratio).

2.4 L.H./F.M.T. (Before the job)

The L.H./F.M.T. is to:-

(a) Record the receipt of the I.226 sheet.

(b) Retain the I.37 slip for the period shown in B.S.I. No. 203.

(c) Forward the I.226 sheet to the Clerk-Meter Records for attachment of test cards for existing installations and record the fact. (Use form MS.96 for this and other details)

(d) Record telephoned advice of anticipated C.T. work.

(e) Allocate the work.

(f) Maintain a follow-up to ensure completion of the work.

2.5 Technician. (On site)

The Technician Gde. 4 is to carry out the necessary tests detailed in Clauses 4, 5 and 6. In the event of the installation not being energised, he is to make enquiries regarding energisation and return all cards to the L.H. for further follow-up and allocation of work.

After testing, the cards are to be checked for the correctness of information entered and the Change Record Card initialled for correctness of the "K". All cards are to be forwarded to the L.H.

2.6 L.H./F.M.T. (After the job)

The L.H. is to check the work and forward through the Foreman Meter Change Records and Test Cards to the Clerk-Meter Records.

2.7 Clerk-Meter Records.

(a) The Clerk-Meter Records is to liaise with the L.H./F.M.T. on the follow-up of incompleted work by use of the Meter Movement File Query Listings and Follow-Up Reports. In this regard, the retention of Change Records by the L.H./F.M.T. will delay the "Accounts Confirmed" part of the procedures detailed in B.S.I. No. 1500. (This delay will be tolerated to ensure that metering is checked before the issue of accounts).

(b) Meter Change Records are to be dealt with as detailed in B.S.I. No. 1500. (Computerisation)

C.T. Test Cards are to be filed in Section order (i.e. meter reading sequence order). A C.T. Record Card MS.76 is to be completed showing the address at which the C.T. is installed, the Serial No. and the I.B.O. No. on which the C.T's were acquired. These cards are to be filed in numerical order of type.

3. CURRENT TRANSFORMERS AND CONNECTION CHECKS.

3.1 Current Transformers.

Metering current transformers are purchased or constructed by Council to conform with Class 0.5 to A.S. C388. Current transformers of Class AM, the equivalent classification of an earlier specification, now superseded by A.S. C388 are also satisfactory. Current transformers which do not meet the requirements of either of these specifications should be scheduled for replacement by Electrical Installation Branch.

All current transformers are individually tested prior to issue from store. (Refer B.S.I. No. 1501 for details). The tests prove polarity, ratio on all taps, ratio error and phase angle errors. However, where practicable, confirmatory tests shall be carried out upon installation.

Appendix E shows the standard terminal arrangement, polarity marks and nameplate details for multi-ratio current transformers. A single ratio extended range current transformer having a range from 0-400A and known as Type S when used with mounting brackets and Type SX when used within a cabinet will shortly come into use; as only two terminals are involved a diagram is considered unnecessary.

3.2 Wiring Connections.

Correct wiring of the current transformer secondary connections and voltage connections, to the meter, are essential and the step by step procedure for checking the correctness of connections of a L.V. current transformer metering installation is detailed in Appendix C.

Appendix F shows the standard connections and colour coding for installations using polyphase and single phase meters and with various types of test blocks.

The metering connections shall be checked and a current transformer ratio and polarity test shall be carried out on all new or altered low voltage current transformer metering installations subject to the provision of satisfactory screening being practicable and in all cases where the accuracy of the metering is queried by a customer. Where the meter is queried by the Treasury Branch and the query cannot be satisfactorily explained, a full connection check, as set out in the appendix to this Instruction shall be carried out. If the reason for the query can be readily explained and a full connection check, including ratio and polarity tests, has been previously carried out it will not be necessary to repeat these tests. When a meter is changed by Metering Services Branch Staff as a routine matter, it will only be necessary to carry out the tests detailed in the "Change of Meter by Metering Services Branch Staff" section of Appendix C provided that a full connection, ratio and polarity tests have been previously carried out.

4. METERS.

4.1 Laboratory Tests.

Meters shall be tested initially, in the laboratory, in accordance with the requirements of B.S.I's Nos. 1000 and 1003.

Single phase meters shall be tested at 0.25 and 5.0A U.P.F. and 5.0A at 0.5 p.f. lag. The meters shall be adjusted to within the limits specified in Appendix A (1).

Polyphase energy meters including energy demand meters shall be tested single element at 10% and 100% basic current U.P.F. and 100% basic current at 0.5 p.f. lag and polyphase at 5% and 100% basic current U.P.F. and 100% basic current at 0.5 p.f. lag. The elements of polyphase meters shall also be balanced one to the other at 100% basic current U.P.F. The meters shall be adjusted to within the limits specified in Appendix A (2).

Demand registers shall be tested at 50% load and the error shall not exceed 1% of the Full Scale Value.

Typical optimum characteristic curves derived from the consideration of errors of polyphase meters of various makes and types are tabulated in Appendix B.

4.2 Field Tests.

The meters shall be tested generally in accordance with B.S.I. No. 1001.

(i) Single phase meters shall be tested at 0.25A and 5.0A U.P.F. and 5.0A at 0.5 p.f. lag.

As these meters have been adjusted to within ± 0.3% under controlled conditions in the laboratory it is desirable that no field adjustments be carried out. If the meters are found to be outside the limits allowed in B.S.I. No. 1000 the matter shall be referred to the supervisor.

Current transformer errors shall not be compensated unless specifically instructed to do so.

(ii) Polyphase meters shall be tested single element at 10% and 100% basic current U.P.F. and 100% basic current at 0.5 p.f. lag and polyphase at 5% and 100% basic current U.P.F. and 100% basic current at 0.5 p.f. lag. Basic current shall be taken as 5.0A for all polyphase meters.

The errors of E.S.A.A. pattern current transformer types A, B, C and S shall not be compensated.

The errors of old pattern current transformer shall be compensated when errors exceed ± 0.3%.

If, when tested polyphase, the meters are found to be outside the limits allowed in B.S.I. No. 1000, the meter shall be adjusted.

The demand register of any energy demand meter shall be checked on each occasion that the energy meter is tested. The test may be carried out at the circuit loading at the time of the test or if a phantom load is used the load shall be not less than 50% of its full scale value.

5. TRANSFORMER RATIO CONSTANT.

All new and replacement C.T. connected meters will have secondary kilowatt hour registers which will necessitate the registration being multiplied by a transformer ratio constant to obtain primary kilowatt hours.

It is necessary that this constant be displayed on the meter and that it agrees with the connected ratio of the current transformer. The Technician Grade 4 responsible for the correctness of the metering installation shall ensure that the correct constant is displayed on the appropriate meter by an approved self adhesive label, fixed externally on the meter glass in a position on the extreme right hand side immediately below the disc of the meter.

The Technician's signature on the Meter Change Record will be his certification that the transformer ratio constant recorded is correct.

6. "WOODSON CHECK".

A test method for determining the relative phase angles between voltages and currents of a polyphase system may be determined from a series of tests in which the current of one phase is associated with the voltages of each of the three phases in turn. This test is repeated for the current of each of the other two phases providing a total of nine results. From the nine results (3 for each current) a vector diagram may be constructed showing the angular position of each phase current. As each phase current will generally have a component in phase with each of the three voltages, the angular position of the currents producing these components is unique.

The polyphase test kit is an instrument which is readily adapted to carry out such tests. Whereas the "Woodson Check" is carried out with an instrument containing nine meter elements, the polyphase kit enables such a test to be carried out on a phase basis and is repeated for each phase. With L.V. current transformer metering the procedures outlined in Appendix C will obviate the need for a "Woodson" check but if the customers load is fluctuating severely, or of such magnitude that the added load test specified in Appendix C is inconclusive, a Woodson Check (as detailed in Appendix D) should be carried out.

If any uncertainty exists as to the validity of any test refer the matter to your Supervisor.

7. CANCELLATION OF INSTRUCTIONS.

This instruction cancels and supersedes the following instructions.

B.S.I. NO.	DATE	SUBJECT
1044	9. 7.71	Meter Testing - Field and Laboratory Testing of Single Phase C.T. Meters.
1014	14. 5.69	Meter Testing - Verification of Reading Constant of Current Transformer Connected Meters.
1207	15. 5.69	Meter Installation - Checking of Low Voltage Current Transformer Metering Connections for Single Phase and Polyphase Meters.
1221	10. 7.69	Meter Installation - New and Altered Low Voltage Current Transformer Installations - Receipt of Advice by the Meter Branch and Arrangements for Checking of Connections.

The contents of the above Instructions have been incorporated into this one Instruction covering procedures and relevant information associated with L.V. current transformer metering.

8. ATTACHMENTS TO THIS INSTRUCTION.

The following appendices are attached to this Instruction and form part of and shall be used in conjunction with this Instruction.

Appendix A - Calibration Points C.T. Connected Single Phase Magnetic Flotation Meters.

Appendix B - Typical Characteristic Curves of Various C.T. Connected Polyphase Meters, Single Element and Polyphase Calibration Load Values and Aiming Points.

Appendix C - Procedure for Checking Connections of L.V. Current Transformer Installations.

Appendix D - The Conversion and Use of the L.V. Polyphase Test Equipment as an "On Load" Connection Checker. "Woodson Check"

Appendix E - Low Voltage Multi-Range Current Transformers. Secondary Terminals, Nameplate and Polarity Mark Details.

Appendix F - Low Voltage Current Transformer Metering Connections to Various Types of Test Blocks.

Appendix G - Code for Installation Work.

9. RELATED BRANCH INSTRUCTIONS.

B.S.I. No. 1000 - Testing and Calibrating New Single Phase A.C. Meters.

B.S.I. No. 1001 - Field Testing of Low Voltage A.C. Single Phase Meters.

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B.S.I. No. 1003 - Testing and Calibrating Used Single Phase A.C. Meters.

B.S.I. No. 1015 - Checking Phase Rotation.

B.S.I. No. 1042 - Periodic overhaul - demand metering, etc.

B.S.I. No. 1500 - Meters - Computerisation.

B.S.I. No. 1501 - Current Transformers - Processing.

10. ISSUE.

Issue to: Code AS, FM
Area.Sup.E.(S), S.I.O.

J. E. Jeans.

PRINCIPAL ENGINEER-METERING SERVICES.

APPENDIX A.

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CALIBRATION POINTS - C.T. CONNECTED METERS.

1. SINGLE PHASE METERS.

TYPE	LOAD	POWER FACTOR	LIMITS
WF3 & M-1	0.25A	Unity	0.3%- to 0.3%+
	5.0A	Unity	0± to 0.3%+
2.5-10A ✓ 2.5-15A	5.0A	0.5 (lag)	0.3%- to 0.3%+

2. POLYPHASE METERS.

METER TYPE & SIZE	SINGLE ELEMENT			POLYPHASE		
	10% B.C. U.P.F.	100% B.C.		5% B.C. U.P.F.	100% B.C.	
		U.P.F.	0.5 LAG P.F.		U.P.F.	0.5 LAG P.F.
SD 3x5A	.5- to .5+	0 to .6+	.3- to .3+	0 to 1.0+	.3+ to .9+	.2+ to .8+
SD-M 3x5A	.5- to .5+	.5- to .1+	1.1- to .5-	.5- to .5+	.3- to .3+	.3- to .3+
LGMLED(2R) 3x5A(2/6)	.5- to .5+	.5+ to 1.1+	.9+ to 1.5+	.5- to .5+	1.0- to .4-	.6- to 0
LGML2R 3x5A(5/10)	.5- to .5+	.5+ to 1.1+	.9+ to 1.5+	0 to 1.0+	0 to .6+	0 to .6+
LGMG(2R) 3x5A	0 to 1.0+	.3+ to .9+	.5+ to 1.1+	.5- to .5+	.3- to .3+	.3- to .3+

NOTE: 100% B.C. is to be taken as 5 amperes.

A. G. Jeans

PRINCIPAL ENGINEER-METERING SERVICES

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APPENDIX B.

TYPICAL CHARACTERISTIC CURVES OF VARIOUS C.T. CONNECTED POLYPHASE METERS,
SINGLE ELEMENT AND POLYPHASE CALIBRATION LOAD VALUES AND AIMING POINTS.

METER TYPE AND SIZE		5% RC UPF	% BASIC CURRENT								CALIBRATION AIMING POINTS						METER TYPE AND SIZE
			10%		20%		50%		100%		SINGLE ELEMENT			POLYPHASE			
			UPF	.5 LAG PF	UPF	.5 LAG PF	UPF	.5 LAG PF	UPF	.5 LAG PF	10% BC UPF	100% BC UPF	100% BC .5 LAG	5% BC UPF	100% BC UPF	100% BC .5 LAG	
SD 3x5A	AVERAGE OF ELEMENTS		0		.3-	.1+	.2-	.1-	.3+	0	.5- to .5+	0 to .6+	.3- to .3+	0 to 1.0+	.3+ to .9+	.2+ to .8+	SD 3x5A
	POLYPHASE	.5+	.2+		.2-	0	.3+	0	.6+	.5+							
SD-M(2R) 3x5A	AVERAGE OF ELEMENTS		.1+		.2+	.3+	.3+	0	0	.3-	.5- to .5+	.3- to .3+	.6- to 0	0 to 1.0+	.3- to .3+	.3- to .3+	SD-M(2R) 3x5A
	POLYPHASE	.5+	.4+	.6+	.2+	.3+	.4+	.2+	0	0							
LGMLED(2R) 3x5A(2/6)	AVERAGE OF ELEMENTS		.1+	1.2+	.4+	.3+	.9+	.9+	.8+	1.2+	.5- to .5+	.5+ to 1.1+	.9+ to 1.5+	.5- to .5+	1.0- to .4-	.6- to 0	LGMLED(2R) 3x5A(2/6)
	POLYPHASE	0	.2-	.3-	0	.1-	.1+	.2+	.7-	.3-							
LGML2R 3x5A(5/10)	AVERAGE OF ELEMENTS		0				.3+	.9+	.8+	1.2+	.5- to .5+	.5+ to 1.1+	.9+ to 1.5+	0 to 1.0+	0 to .6+	0 to .6+	LGML2R 3x5A(5/10)
	POLYPHASE	.5+	.4-	.3+	.4-	.2+	.1-	.1-	.3+	.4+							
LGMG(2R) 3x5A	AVERAGE OF ELEMENTS		.6+				.4+	.7+	.6+	.8+	0 to 1.0+	.3+ to .9+	.5+ to 1.1+	.5- to .5+	.3- to .3+	.3- to .3+	LGMG(2R) 3x5A
	POLYPHASE	0	0	.2+	.1+	.2-	.1+	.2-	0	.1-							

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PRINCIPAL ENGINEER METERING SERVICES

APPENDIX C.

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PROCEDURE FOR CHECKING CONNECTIONS OF L.V. CURRENT TRANSFORMER INSTALLATIONS.

1. Check that C.T. size corresponds with that specified for the job and that, where applicable, the transformer is on the correct tapping. Where doubt exists check with ammeter in secondary circuit and tong test the primary circuit. Bare busbars adjacent to phase being measured must be screened before applying tong test.

2. Ensure that voltage circuit fuses are of 10 ampere rating H.R.C. type with sweated tags. (Some fuses had tags fitted to "press on" caps and developed high resistance connections). Quote

3. Check test lamps and ensure that the 240 volt supply is available at the fuses and at each meter or each phase of a polyphase meter.

4. Prove that the phase rotation is standard. (See B.S.I. No. 1015)

5. Remove the appropriate voltage circuit fuse or all voltage circuit fuses in the case of polyphase meters and observe that meter stops.

6. Replace the fuse of each single phase meter and observe rotation of the disc or in the case of a polyphase meter replace each fuse in turn so that only one fuse is connected at any time.

7. Apply auxiliary load and by switching the auxiliary load and repeating the tests outlined in the preceeding step (6), check that the meter disc increases in speed in the forward direction or, if rotating in the reverse direction, that its speed decreases with the applied load. The customer may be able to vary his load to take the place of applied auxiliary load.

8. Where meter disc reversal is observed the cause must be ascertained. A check with the customer may reveal that a 415 volt single phase load of low power factor such as a welder may be connected.

9. If the preceeding "proving" tests Nos. 5, 6 & 7 cannot be carried out, or uncertainty exists, the correctness of connections may be proved by a "Woodson Check" as outlined in Appendix D.

10. If any uncertainty still exists report the matter to your supervisor.

11. Check the tightness of all connections and proceed with Meter Test.

12. After completion of test, replace links and again check that all connections are tight. Remove any discarded seals, sealing wire or other rubbish for which you may be responsible.

Change of Meter by Metering Services Branch Staff.

These procedures only apply where a meter is to be changed by Branch Staff and the Technician has confirmatory evidence that the connections and the ratio and polarity of the current transformers have previously been checked.

13. Withdraw metering voltage fuses.

APPENDIX C (CONT)

14. Bridge the current transformer secondary circuits at the test block then open the test links.

15. Change the meter.

16. Insert "Red" phase fuse and from the meter terminals energise the 3A load box provided.

17. Apply the output test prods of the 3A box to the appropriate current terminals of the test block and observe that the meter disc revolves in a forward direction.

It is essential that the Red alligator clip is connected to the energised voltage terminal at the meter and that the Red test prod is connected to the polarity current terminal at the test block.

18. Withdraw Red phase fuse and insert Yellow phase fuse, repeat steps 16 and 17.

19. Withdraw Yellow phase fuse and insert Blue phase fuse, again repeating steps 16 and 17.

20. Replace all fuses and check that phase rotation at the meter is standard.

21. Prove that all connections are tight and proceed with meter test.

22. After completion of meter test and removal of test leads, replace links, remove bridges, ensure that all connections are tight and, where load exists, that the meter is registering.

23. Ensure that old seals, sealing wire and any other rubbish for which you may be responsible [redacted] is removed.

PRINCIPAL ENGINEER-METERING SERVICES

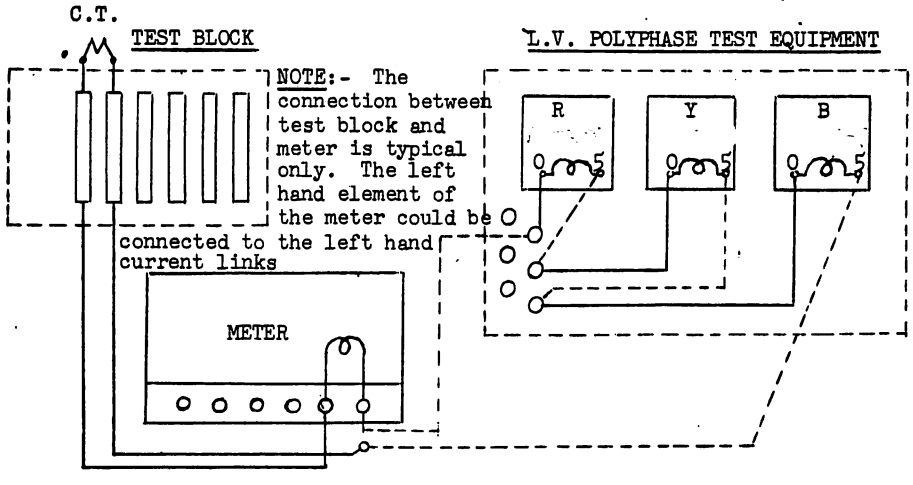
THE CONVERSION AND USE OF THE L.V. POLYPHASE TEST EQUIPMENT AS AN "ON LOAD" CONNECTION CHECKER.

"WOODSON CHECK.

The polyphase test equipment comprises three standard watthour meters and is, therefore, suitable for the purpose of a "Woodson Check" as outlined in B.S.I. No. 1002, Clause 6.

The equipment should be connected and used as follows:-

1. Remove the connection from the 5 amp. range terminal of each Standard Watthour Meter
2. Connect the Yellow current non-polarity output terminal to the 5 amp. range terminal of the Red
3. Connect the Blue current non-polarity output terminal to the 5 amp. range terminal of the Yellow
4. At the test block bridge all current transformers and open the movable links of Yellow and Blue phases.
5. Withdraw the "Red" non-polarity wire from the meter and connect it to the 5 amp. range terminal of the Blue
6. Connect the Red non-polarity meter terminal to the Red current non-polarity output terminal of the L.V. Polyphase Test Equipment.
7. Remove the bridge from the Red current links at the test block.
8. Put the P.F. Selector Switch of the L.V. Polyphase Test Equipment in the "Off" position and energise the Equipment (with three phases and neutral) from the test block or meter.
9. Set each to zero and switch on their voltage circuits.



---------- TEMPORARY CONNECTIONS

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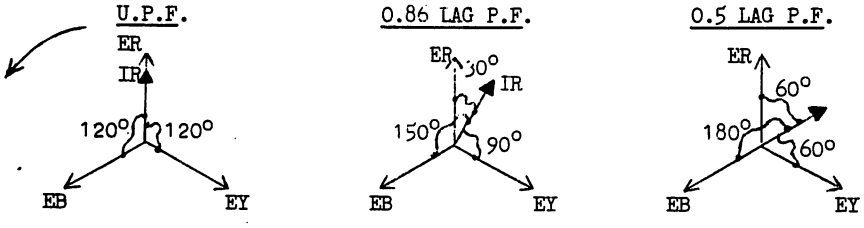
APPENDIX D (CONT.)

The condition now is that the Red secondary current is passing through each current coil and is associated with Red, Yellow and Blue voltages respectively. The direction and comparative speed of rotation of the will depend on the phase angle of these associations, it being assumed that the phase voltages are equal and symmetrical.

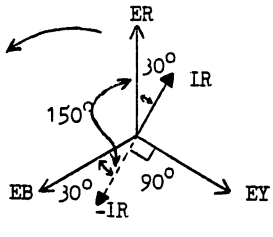
Some vector representations for various conditions are shown:-



The following tabulation shows the conditions for each y at the various power factors illustrated.

P.F.		PHASE ANGLE, VOLTAGE AND CURRENT	COSINE & SUM OF R.Y.&.B.	DIRECTION AND COMPARATIVE SPEED	
1.0	Red	0	+1.0)	Forward	1.0
	Yellow	120°	-0.5) = 0	Reverse	0.5
	Blue	120°	-0.5)	Reverse	0.5
0.86 Lag	Red	30°	+0.86)	Forward	0.86
	Yellow	90°	0) = 0	Stopped	0
	Blue	150°	-0.86)	Reverse	0.86
0.5 Lag	Red	60°	+0.5)	Forward	0.5
	Yellow	60°	+0.5) = 0	Forward	0.5
	Blue	180°	-1.0)	Reverse	1.0

The above analysis has shown the respective direction and comparative speed of each for known values of power factor. It has also shown that if connections are correct, the sum of the three readings is equal to zero. It does not prove, however, that the polarity of the current transformer used in the test (Red) is correct, for example assume that the Red current transformer polarity is incorrect and the load power factor is 0.86 lagging.



IR shown lagging ER by 30°.
-IR + IR reversed and leading ER by 150°.
The readings obtained would be:-

Red	cos 150°	= -0.86)
Yellow	cos 90°	= 0) = 0
Blue	cos 30°	= +0.86)

APPENDIX D (CONT)

When conducting a test of this nature, experience has shown that most satisfactory results can be achieved by switching the voltages on to the [illegible] and switching the voltages off when the most rapidly moving [illegible] has completed approximately one half ($\frac{1}{2}$) of [illegible] The three readings are then taken and from these results the position of the current vector can be plotted. Bearing in mind that each Rotary rotates at a rate proportional to its voltage, current and the cosine of the angle between them, and further that since the current is common to each and voltages are assumed to be equal and symmetrical, the rate of rotation (the reading obtained) is proportional to the cosine or the in-phase component.

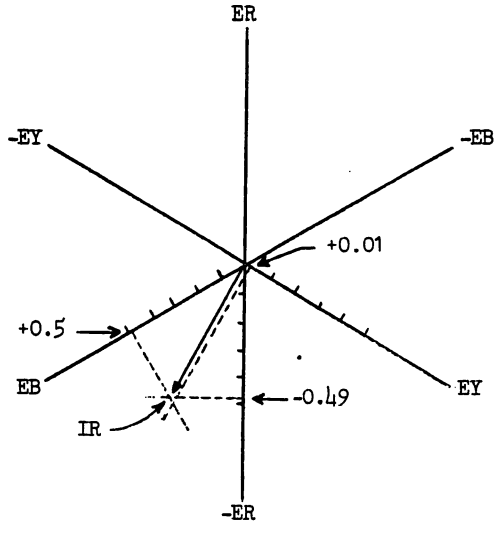
The direction of rotation of the meter under test should be observed; its direction should be the same as that of the Red Rotary.

In general the Red Rotary will always read positive for correct connection. The exception to this would be when a low power factor 415 volt load is connected. The effect of such a load is explained under "General".

Suppose the readings of the Rotaries were as follows:-

Red	-0.49 revolutions
Yellow	+0.01 revolutions
Blue	+0.50 revolutions

Using the diagram below and as shown on card, MS.67, plot these values to scale on the appropriate voltage vectors and draw perpendiculars to them. The intersection of the three perpendiculars will give the locus of the current vector as illustrated.



This example indicates that IR leads ER by approximately 150° and that either the current transformer polarity was reversed, the association of voltage and current was incorrect, or the "connection checker" had been incorrectly connected into the circuit.

The angular position of Yellow and Blue currents can be determined repeating the procedure with the "connection checker" connected into Yellow and Blue secondary circuits at the meter. It is not necessary to alter any connections at the L.V. Polyphase Test Equipment for this purpose.

APPENDIX D (CONT)

The direction of rotation of the meter should be observed; its direction should be the same as that of the Yellow or Blue Rotary dependent on the phase being investigated at the time.

When Yellow and Blue current vectors are plotted, it should be possible to determine whether, for example in the case of Red current leading by 150°, this is due to reversed polarity or incorrect association of current and voltage.

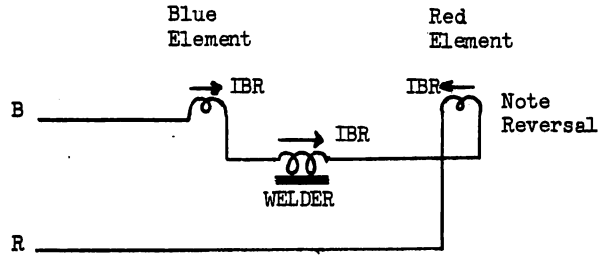
GENERAL.

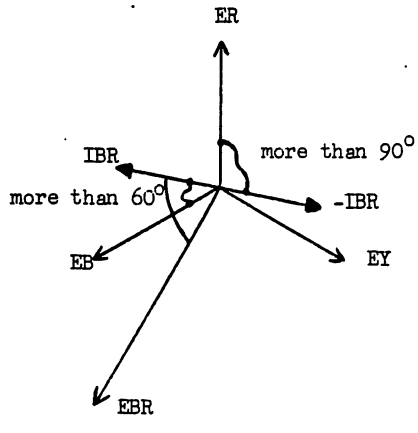
In some cases load may be connected between two phases and the current of such a load could lead or lag the line voltage by almost 90°. As the line voltage is displaced from the phase voltage by 30° the current seen by a particular meter element could be displaced from the voltage of that element by almost 120°.

Industrial and Commercial loads normally operate at lagging power factors. Capacitor load may cause an individual circuit to have a leading power factor but the Council's Service Rules do not permit a customer to operate with a leading power factor.

The type of load which may cause some concern to meter testing personnel is a low power factor 415V load such as electric welding equipment which, when idling, may have a power factor more lagging than 0.5. In large industrial complexes such types of load may be swamped by the general load, but in smaller installations the welding load may, at times, predominate and cause a reversal of one single phase meter or meter element.

In the following diagrams a single phase 415 volt welder is shown connected to Blue and Red phases.





As shown, the line current IBR lags the line voltage EBR by more than 60°. This condition could exist with the welder energised by idling. In the above case the Blue meter or element will see current IBR and voltage EB and will have forward torque.

The Red meter or element will see current IBR and voltage ER and will have reverse torque because the related angle exceeds 90°.

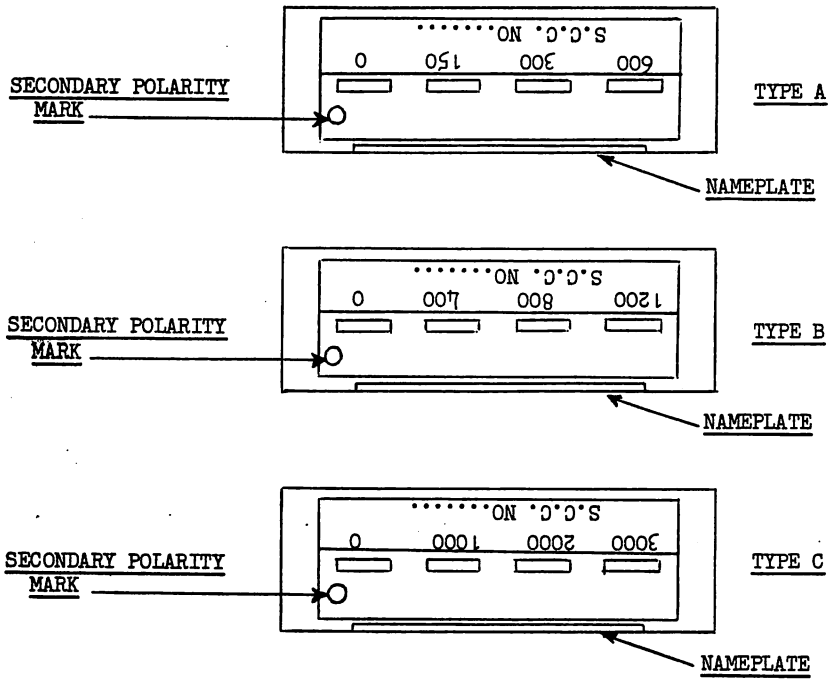
PRINCIPAL ENGINEER-METERING SERVICES

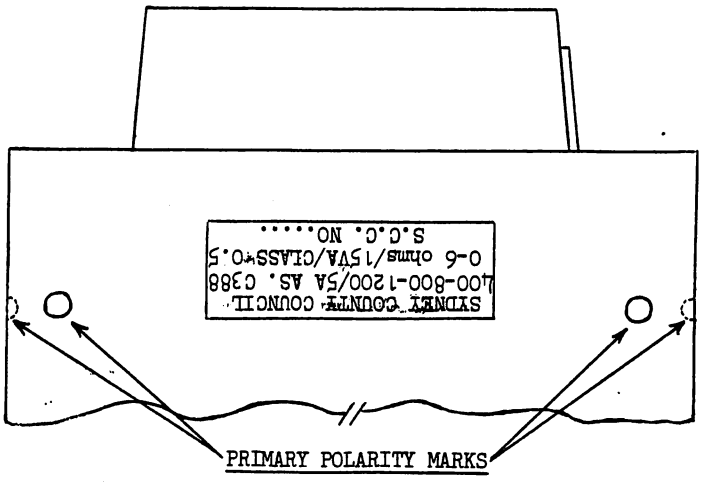
APPENDIX E.

B.S.I. No: 1002
Date: 29.4.74

LOW VOLTAGE MULTI-RANGE CURRENT TRANSFORMERS.
SECONDARY TERMINALS, NAMEPLATE AND POLARITY MARK DETAILS.

FIG. 2.

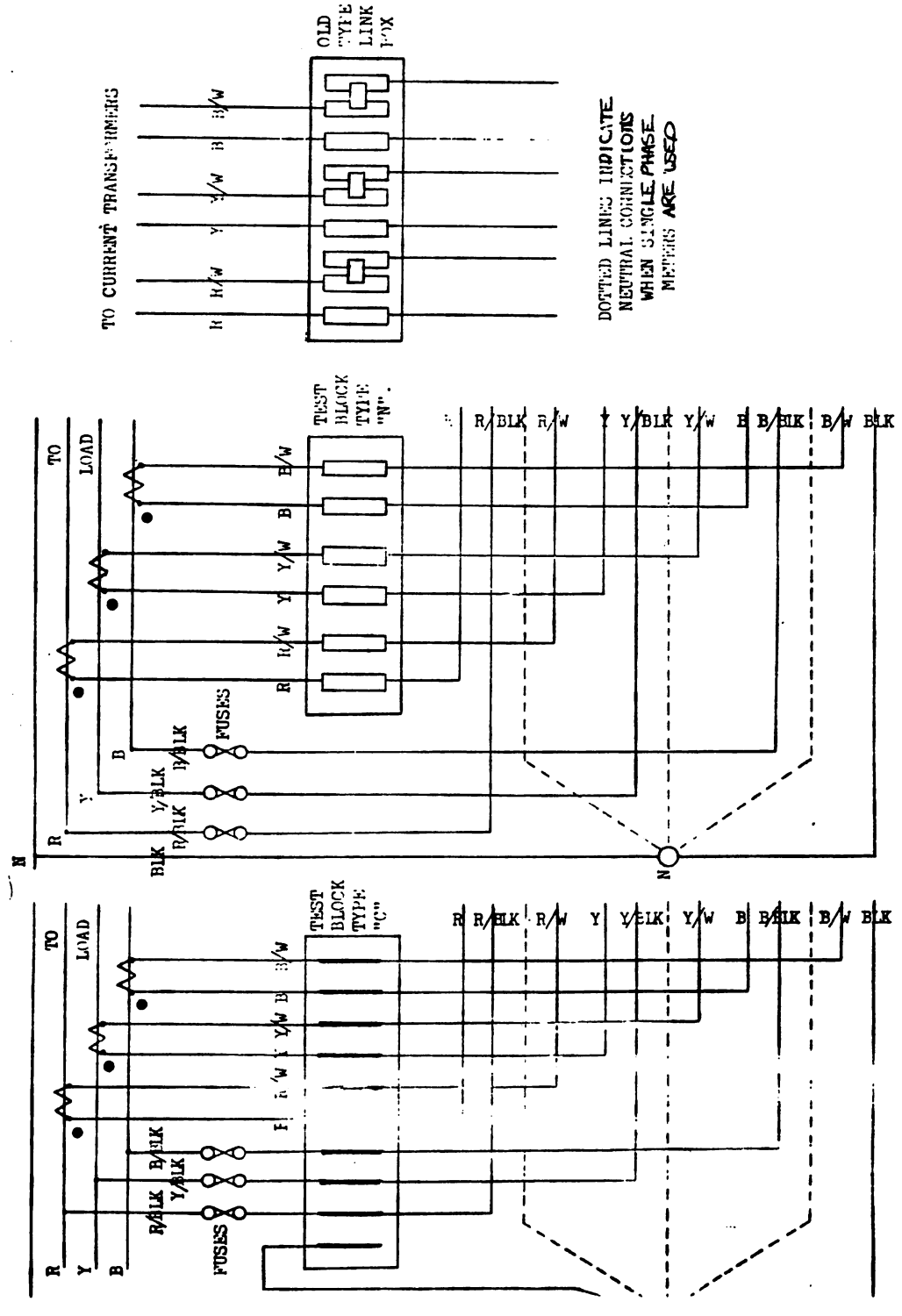




PRINCIPAL ENGINEER-METERING SERVICES

LOW VOLTAGE CURRENT TRANSFORMER METERING CONNECTIONS
TO VARIOUS TYPES OF TEST BLOCKS.

FIG. 1.



S.O.I. No: 1002
Date: 29.4.74

CODE FOR INSTALLATION WORK.

NATURE OF INSTALLATION WORK.	CODE
Existing C.T. Installations.	
Change of meter only for type	C/M
Change of C.T. tapping and K tag	C/T and K
Change of C.T. tapping and meter	C/T and M
Alteration of position only of C.T's and/or meter	A
Change of C.T's for any reason	N
New C.T. Installation.	
Completely new installation	N
Change for direct connected to C.T. metering	N
Delivery of C.T's for mounting by contractor or switchboard manufacturer not involving the connection of meters.	D

PRINCIPAL ENGINEER-METERING SERVICES

REPLACEMENT OF CURRENT TRANSFORMERS

The current transformer must be replaced or the ratio must be changed if the sustained maximum primary current exceeds the value given in Table 4.

C.T.		MAXIMUM CURRENT AMPS.
TYPE	RATIO	
A	150/5	360
A	300/5	700
A	600/5	1350
B	400/5	1000
B	800/5	2000
B	1200/5	2800
C	1000/5	1750
C	2000/5	3000
C	3000/5	3750
S	200/5	520 -See Note 1
T	800/5	2000 -See Note 2
U	2000/5	
WF	4000/5	5000

Note 1. 520A is absolute limit for type S transformers. No short time or intermittent load shall exceed this limit.

Note 2. Current limits given in Table 4 apply only if the C.T. is used in conjunction with a long range (2.5/15A) watthour meter. If an instrument with less than 15A maximum continuous current rating is connected in the secondary circuit, the primary current limit will be calculated by multiplying the rating of the instrument with the C.T. ratio.

Note 3. In installations with block interval demand meters tap changing may be necessary to keep the secondary power in the C.T. circuit within the effective working range of the demand register. Refer to Section 11.

Note 4. The current limits in Table 4 are subject to the adequacy of the primary circuit and sufficient cooling of the C.T. In high ambient temperature, the rating of the C.T. must be reduced.

TO: * PLEASE CIRCULATE.

DISTRIBUTION SUPPORT

METERING SERVICES UPDATE

ISSUE No MSU1 26th NOVEMBER 1992

CHANGES TO EMAIL E1 AND E1R METERS

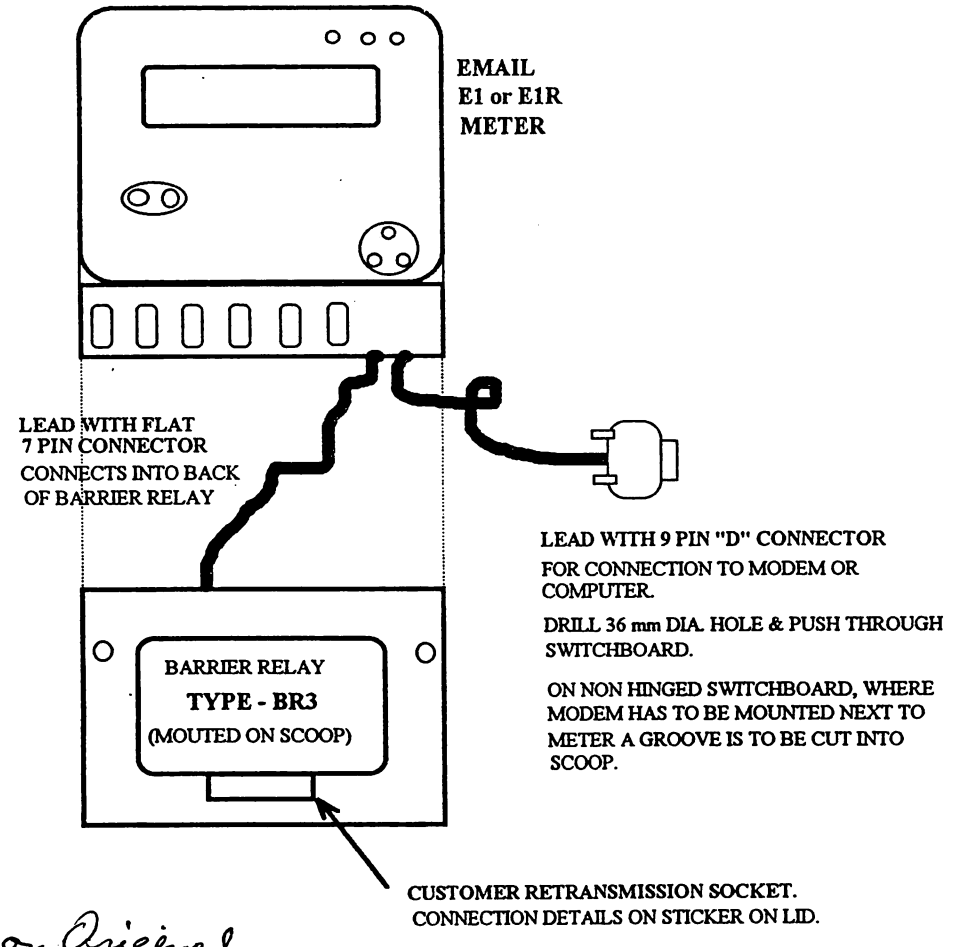
All new **E1** and **E1R** meters will come with two flying leads with connectors instead of a socket in the bottom of the meter. This corresponds with the introduction of a new barrier relay, type **BR3**, to be used exclusively with this type of meter.

The new **BR3** barrier relay is built into the scoop, therefore to install retransmission on a meter the existing scoop is discarded and the barrier relay installed in its place.

In the case of **existing E1R** meters, where retrasmission is required, a special lead will be supplied to connect into the barrier relay or alternatively a new meter may be issued.

Please note that **E1** meters do not have retransmission facilities, but still have these leads attached.

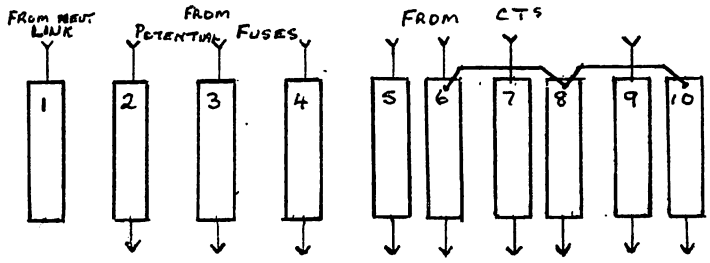
Where no retransmission is required drill a 36 mm diameter hole and push both leads trough to the back of the switchboard.



Signed on Original

V. Church (M-Met. S)

IDENTIFICATION OF TEST BLOCK TERMINALS.



	TO METER	INPUT
1 NEUTRAL.	NONE	BLACK (FROM NEUT. LINK)
2 RED POTENTIAL	RED/BLACK	RED/BLACK
3 WHITE POTENTIAL.	WHITE/BLACK	WHITE/BLACK
4 BLUE POTENTIAL.	BLUE/BLACK	BLUE/BLACK
5 RED POLARITY	RED.	RED
6 RED NON-POLARITY	RED/WHITE	BLACK/WHITE
7 WHITE POLARITY	WHITE	WHITE
8 WHITE NON-POLARITY	WHITE/WHITE	NO INPUT
9 BLUE POLARITY	BLUE	BLUE
10 BLUE NON-POLARITY	BLUE/WHITE	NO INPUT